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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM --

SOVIET BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Animal-Carrying Satellite Makes Sixteenth Trip in Circular Orbit

The following is a full translation of a brief article on current data on the second Soviet animal-carrying satellite, appearing in the 21 August 1960 issue of Izvestiya.

CPYRGHT

Continuing its motion in a given orbit, on 20 August 1960, at 1030 hours Moscow time the space ship-satellite completed its 16th trip around the Earth. Additional telemetric data which have been received indicate that the equipment is functioning normally.

The condition of the animals is satisfactory. In the tenth hour of flight the dog "Strelka" had a pulse rate of 106 and respiration rate of 30 per minute. "Belka" had a pulse of 120 and respiration of 40.

The conditions of the animals is observed regularly via television, and the images are recorded on motion picture film. The motion picture frames thus obtained indicate that at certain moments an increase in respiratory activity of the animals may be observed.

According to the latest data the period of revolution of the satellite around the Earth is 90.72 minutes, the minimum altitude of its orbit is 306 kilometers, and the maximum altitude is 339 kilometers. The decrement in its period of revolution due to air resistance is 0.003 minute per day. The refined value for inclination of the plane of its orbit with the equator is 64 degrees 57.3 minutes.

All units of the terrestrial automatic measuring complex are functioning normally. The great amount of measurement information obtained is processed by electronic computing machines for continuous refinement of the data on the parameters of the satellite orbit. ("Diary of the Flying Laboratory," TASS report, Izvestiya, 21 Aug 1960, p 3)

CPYRGHT

"Strelka" and "Belka" Show Living Organism Endures Weightlessness

Interviewed by an Izvestiya correspondent, Active Member of the Academy of Medical Sciences Professor P. K. Anokhin relates the medical importance of telemetric and television observation of the two dogs in the second Soviet animal-carrying satellite.

Because the reactions of the nervous system and the status of cardiovascular activity are among the most vulnerable to high-altitude flight conditions the two dogs "Strelka" and "Belka," orbited in a Soviet satellite, were fitted with electrodes for measuring the electrical potential generated by the dogs' brains, hearts and musculature, while allowing the dogs freedom to stand, lie down or lie on their sides, and their behavior visually observed via television. The condition of weightlessness has the greatest influence of all factors on the normal functioning of the nervous system. The best criterion of the status of the central nervous system of animals encountering unusual situations is whether conditioned reflexes are interrupted or maintained.

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Although the telemetric readings indicate the ability of the living organism to withstand the shock of blast-off and the condition of weightlessness, the fact that the dogs did feed while in orbit, and especially the fact that their feeding was visually confirmed, was of greatest importance in indicating that their higher nervous activity was normal. ("The Living Organism and Weightlessness," by P. K. Anokhin, Izvestiya, 21 Aug 1960, p 3)

Successful Functioning of Space-Ship-Satellite Discussed

According to a TASS report the animal-carrying satellite launched by the Soviet Union on 15 May 1960 weighed 4 tons 540 kilograms without the last stage of the carrier rocket, included a hermetically sealed cabin with a weight imitating the weight of a man, all equipment necessary for the future flight of man, and various instruments which, together with their power sources, weighed 1,477 kilograms. All the equipment necessary for the future flight of man functioned normally. After telemetric and radiotelephonic data from the satellite were recorded the pressurized cabin was detached from the satellite upon command from the Earth. In the balance of the article senior scientific associate N. Varvarov discusses the creation of a "microcosmos" within space ships of the future, with the necessary plant-animal balance for atmospheric regulation, which will be needed for future flights of months and years duration. ("Space Conquered by Soviet Man," by N. Varvarov, Izobretatel' i Ratsionalizator, No 6, 1960, pp 2-3)

Meteorite Dangers to Space Flight

B. Mirtov, senior scientific associate of the Institute of Applied Geophysics, Academy of Sciences USSR, discusses data on the Earth's atmosphere, and the probability of encountering destructive meteorites in space.

The concentration of particles in the Earth's atmosphere, which is approximately 10^{19} per cubic centimeter at the Earth's surface, decreases one million-fold at an altitude of 100 kilometers, drops to one hundred thousand at an altitude of 1,000 kilometers, and at the limits of the Earth's atmosphere, at an altitude of 20,000 to 30,000 kilometers, drops to the concentration of interplanetary space, or approximately 100 particles per cubic centimeter. The major component of the atmosphere from 200 to 1,000 kilometers is not hydrogen, as had been assumed, but atomic oxygen. The basic component of the atmosphere from 200 to 250 kilometers is, as at the surface, nitrogen, and nitric oxide has been found at altitudes of 100 to 200 kilometers.

The Earth receives approximately 5,000 tons of micrometeorites every 24 hours. Travelling at speeds of 30 to 40 kilometers per second, a meteorite one centimeter in diameter may pierce an aluminum plate 11 centimeters thick. The probability of a satellite of one meter radius

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colliding with such a meteorite, however, is once in one hundred years. Thus, although a hazard does exist, science can cope with this, as with other physical problems. ("Beginning of a Great Journey," by B. Mirtov, Izvestiya, 21 Aug 1960, p 3)

Reviews Soviet Geophysical Rocket and Satellite Program

The authors, Academician A. A. Blagonravov and M. G. Kroshkin, review the Soviet rocket and satellite program from the beginning of the IGY through the newest launching of a single-stage ballistic rocket containing experimental animals and the 5 and 7 July launchings of multi-stage ballistic rockets, and conclude that the flight of man into space and the exploration of other planets have ceased to be fantasies.

The USSR had planned to launch 125 meteorological and geophysical rockets and several artificial satellites during the IGY. A total of 175 actually were launched, 125 during the IGY and 50 under IGC. The rockets were launched from Kheys Island, Franz Josef Land, from the middle latitudes of the Soviet Union, from shipboard off the Mirnyy antarctic base, from the equatorial latitudes and from the northern waters of the Pacific Ocean. A total of 158 launchings involved investigation of the upper stratosphere and 17 geophysical rockets were used for investigation of the structure of the upper atmosphere at altitudes from 100 to 470 kilometers. Six of these contained spherical, self-orienting containers weighing 367 kilograms each, equipped for optical observation and registration of conditions inside and outside the container. Seven launchings to altitudes of 210 km included a detachable section weighing 2,200 kg, consisting of a cabin for experimental animals and an instrument section, and equipped with a parachute device for returning to Earth. A total of nine launchings included hermetically sealed cabins with animals and with control equipment. Radio frequency mass spectrometers were used in connection with these geophysical rockets for determining the chemical composition of the atmosphere up to 450 km. The frequency of micrometeorite collisions in this range was found to be approximately $1.7 \cdot 10^{-3}$ per square meter per second which, however, may rise to 9 collisions per square meter per second at an altitude of 470 km.

Three artificial satellites of the Earth were launched by the USSR under the IGY, and the results of these investigations led to determination of the density of air and the ionic status of the atmosphere up to an altitude of 840 km. The great power of the three Soviet satellite rockets which exceeded altitudes of 5,000 km enabled greater complexity of the investigations conducted through their use. Atmospheric density and temperatures at great altitudes were found to be much greater than had been previously supposed. Other observations included the following: great variations were observed in the density of the upper atmosphere and these variations were related to solar activity; very strong currents and great turbulence were found in the upper atmosphere; the atmosphere above 250 km was found to have basically atomic composition,

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with a preponderance of atomic oxygen; ionospheric measurements indicated the lack of a sharply defined layer of electron concentration; the concentration of positive ions at 795 km was found to be $1.6 \cdot 10^5/cm^3$; data were obtained on the ionic composition of interplanetary space, and the increased concentration of charged particles in the vicinity of the Moon was found to coincide with radio astronomical observations; analysis of the decrease in intensity with altitude of the Eastern Siberia magnetic anomaly enabled conclusions to be made concerning the distribution of its sources in the Earth crust; data were obtained on the intensity of corpuscular and ultraviolet radiation of the Sun and of cosmic irradiation of the upper atmosphere, including short-period fluctuations in the intensity of cosmic irradiation at an altitude of several hundred kilometers; data were obtained on the density of meteoritic material in the upper atmosphere and in interplanetary space, and on the dimensions and energy of micrometeorites; medico-biological experiments revealed the ability of the animal organism to withstand the strain of rocket acceleration and of long periods of weightlessness. The data obtained by various methods are in agreement, and in general the data of Soviet and foreign investigators also coincide.

Because each research step depends upon the steps preceding it, it is difficult to predict the sequence of future geophysical experiments. The practical problems which should be investigated first, however, include the following: detailed investigation of air currents at various altitudes; their turbulence; the pressure and density of the atmosphere over the entire Earth surface; explanation of the character of changes in all these factors with geographic latitude and their seasonal, local and temporal variations; development of an outline of the general circulation of the atmosphere; the thermodynamic characteristics of the atmosphere, including the sources of atmospheric heating; delineation of large-scale structural irregularities of the ionosphere and in the formation of the F_2 layer; the radiation balance of the Earth; more precise determination of the Earth's albedo; clarification of the fact that magnetometric data obtained through artificial satellites do not coincide with the liquid core-flux theory of the Earth's magnetic field; detailed investigation of the effects of the variable component of the Earth's magnetic field in atmospheric and meteorological processes. ("Geophysical Investigations With the Aid of Rockets and Artificial Satellites," by A. A. Blagonravov and M. G. Kroshkin, Vestnik Akademii Nauk SSSR, No 7, 1960, pp 7-20)

Two New Soviet Books on Artificial Earth Satellites

Two new books on artificial earth satellites have been issued by the Publishing House of the Academy of Sciences USSR.

Iskusstvennyye Sputniki Zemli (Artificial Earth Satellites), No 4, Moscow 1960. This is a 206-page illustrated book. In it, the characteristics of the motion of an artificial satellite in the Earth's normal

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gravitational field, the determination of the parameters of its orbit according to the data of ground-based measurements, the measurement of cosmic rays by geophysical rockets and other problems are considered.

Iskusstvennyye Sputniki Zemli (Artificial Earth Satellites), No 5, Moscow, 1960, is a 77-page illustrated book. This book contains information on the orbits of the cosmic rockets launched towards the Moon, magnetic measurements, measurements of radiation, the investigation of cosmic rays during the flight of the second cosmic rocket to the Moon, the determination of the conditions of visibility of the cosmic rockets and other problems. ("New Books"; Moscow, Vestnik Akademii Nauk SSSR, No 7, 1960, p 120)

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II. UPPER ATMOSPHERE

Thermal History of the Moon

In an article in Reports of the Academy of Sciences USSR, signed for publication 2 March 1960, B. Yu. Levin and S. V. Mayeva of the Institute of Physics of the Earth imeni O. Yu. Shmidt, of the Academy of Sciences, adduce computations in an examination of the possible evolution of the Moon which, by analogy, also may apply to the Earth. The theory examined is to the effect that the Moon originated through the amassing of cold bodies which, through their radioactive material content, resulted in the fusion of the Moon's core to a mathematically important "initial" temperature. The period of formation of the Moon is taken as $0.23 \cdot 10^9$ years, and the growth of the Moon has continued $5 \cdot 10^9$ years, including its formative period. In the computations the surface temperature is taken as 0° Centigrade, which conforms to the approximate equatorial temperature. Comparison with the polar temperatures of -150° C, however, lead to the conclusion that there are no light, molten masses in the Moon's mantle which may penetrate to the surface, and that the Moon is solid to a depth of at least 500 to 700 km. The average content of radioactive materials in the Moon is taken to be equal to that of meteorites. The Moon's heat capacity was at 0.2 cal/g·degree. ("Some Computations on the Thermal History of the Moon," by B. Yu. Levin and S. V. Mayeva, Doklady Akademii Nauk SSSR, Vol 133, No 1, 1960, pp 44-47)

III. METEOROLOGY

Changes in Water Content of Snow Cover Measured With Isotopes

Yu. I. Agashkin of the Geographical Institute, Academy of Sciences USSR, describes the method used in determining the water content of the snow cover of the Klin-Dmitrov ridge in Moscow Oblast. The method consists of embedding a source of radiation underneath the snow cover and reading the radiation level at the surface. This work, begun in 1957 by the Geographical Institute, presently is being continued with the complex participation of other institutions under the project title of "The Heat and Water System of the Earth Surface." ("Investigation of Snow Thaw By the Radioisotope Method," by Yu. N. Agashkin, Izvestiya Akademii Nauk SSSR, No 4, 1960, pp 117-121)

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IV. OCEANOGRAPHY

Oceanographic Committee Reviews Work on Physical Phenomena

The following is a complete translation of a one-page article in Vestnik Akademii Nauk SSSR dealing with recent work on the computation and forecasting of physical phenomena.

The Oceanographic Committee under the Presidium of the Academy of Sciences USSR held a plenum from 17 to 22 March, devoted to the problems of the computation and prognosis of physical phenomena in the sea. Specialists of more than 40 scientific research institutes and production organizations participated in the plenum.

The reports which were heard indicated that during the recent past considerable research on the prognosis and computation of marine processes, swells, tides, ice phenomena, and in the fields of thermals and turbulence have been conducted in many institutions of the country. Much attention is being devoted to the problems of the organization of modern oceanographic work.

Theoretical investigations and generalization of data obtained in observations of ocean waves have led to the development of methods for the computation of their elements, on the basis of which practical manuals have been compiled. The calculated procedures have found extensive application in engineering practice. The new methods for calculation of oceanic processes are very valuable (especially in the computation of the interaction of the fields of speed and density). Participants at the plenum were familiarized with the work done at the Central Institute of Forecasts which enables calculation of processes at sea according to atmospheric pressure.

Success has been achieved in the application of computation methods for determination of harmonic constants, in the development of a hydrodynamic theory of the propagation of tidal waves, "tsunami" waves, and waves formed in connection with changes of atmospheric pressure. The tables of constant-action tides, developed at the State Oceanographic Institute, are of very great importance in practice.

Recent work on direct measurement of pulsations and computation of the value of the coefficients of turbulence for depths down to 2,000 meters have revealed these to be considerably greater than those known to the present time (works of the Moscow Hydrophysical Institute of the Academy of Sciences USSR, and of the Chair of Physics of the Sea, of the Moscow University).

In the field of thermals the transition to calculation of water temperature on the basis of heat balance is a major achievement. The practical utilization of this method has been made easier through simplification. The problems of heat balance were discussed in very lively debate at the plenum.

A series of reports concerned prognosis of ice phenomena of the North Sea route and of non-arctic seas of the country.

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The plenum noted the necessity for further development of the theory of wind waves on the basis of the results of laboratory investigations and natural observations, taking into account turbulent process in the air and in the water.

Serious attention must be devoted to computation of the dying out of waves with lessening of wind velocity, to the computation of sea swells and to the propagation of waves in shallow coastal areas.

Some sections of the Oceanographic Committee (primarily the basin section) recommended greater specification of the volume and content of expeditionary sea investigations, from the point of view of development of methods of calculation and prognosis. First of all, thematic expeditions must be conducted, and oceanographic observations of multi-diurnal cycles must be performed.

The development and industrial production of automatic, drifting island, aircraft and shipboard technical means for gathering information on the hydrometeorological situation in open portions of oceans and seas, and also of rapid-calculation equipment for the processing of this information must be corrected.

The plenum approved motions for the organization of international expeditions on special research themes, especially in connection with investigation of ocean currents and waves. ("Computations and Prognoses of Physical Phenomena In the Sea," by Yu. V. Istoshin and S. I. Kan-[illegible], Vestnik Akademii Nauk SSSR, No 7, 1960, pp 95-96)

Submarine Biological and Marine Laboratory Completes Five Voyages

V. Azhazha, vice president of the Bureau of the Underwater Investigations Section of the Oceanographic Committee of the Academy of Sciences USSR, describes the first five voyages of the submarine "Severyanka" as an undersea biological and marine laboratory in a recent issue of Pravda.

The submarine "Severyanka," equipped with three underwater "illuminator" observation windows and carrying personnel of the All-Union Scientific-Research Institute of the Sea Fish Industry and Oceanography (VNIRO), has spent a total of 80 days submerged and covered approximately 10,000 miles in five voyages in the Barents Sea and the North Atlantic. The first, or test voyage, revealed the "Severyanka's" usefulness for underwater investigation of the habits of fish. In January 1959 the "Severyanka" sailed on its second voyage and, encountering a severe storm in the Atlantic, sailed to Iceland and to the Faeroe Islands, where the Soviet herring fleet was operating and observed the behavior of the Atlantic herring. During the third expedition the submarine studied trawling at various depths, and frequently rested on the bottom, amidst flounder "pastures." On its fourth voyage the "Severyanka" sailed into the North Atlantic and to Jan Mayen Island. During the month which the scientists spent in the depths they discovered, and determined the limits of false sonar indications created by great masses of plankton. The fifth voyage was devoted to study of the habits of cod, one of the major industrial fish of the Soviet fishing industry. In addition to taking motion pictures of fish through the "illuminator" ports, the surrounding medium of

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the boat was studied, water temperature was taken, and the salinity, radioactivity and chemical composition of the water were determined. Although more than twenty such voyages still must be made, the "Severyanka" already has joined the ranks of such sea-going marine laboratories as the surface vessels "Vityaz'," "Lomonosov" and "Voyeykov." The "Severyanka" serves the cause of peace, opening a new aspect in the history of the underwater fleet. A photograph is included of the "Severyanka" meeting with its "colleague," the surface vessel "Persey-2," in the Sea of Barents. ("10,000 Miles Under Water," by V. Azhazha, Pravda, 10 Aug 1960, p 6)

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Dumping Radioactive Waste in Ocean Cited as Dangerous

Although V. G. Bogorov and Ye. M. Kreps presented a report at the September 1958 international conference on utilization of atomic energy at Geneva, demonstrating the impossibility of dumping radioactive wastes in ocean trenches, the problem is reviewed again in an article based on data accumulated since 1958. The argument is that because of physical and biological circulation the wastes will not remain confined to the deep ocean trenches, and in leaving the trenches the radiation will not be distributed evenly throughout the oceans, but because of localized circulation will not be evenly distributed for a very long period of time. Additional studies are recommended. ("The Ocean Depths and the Problem of Storing Radioactive Wastes in Them," by V. G. Bogorov and B. A. Tareyev, Izvestiya Akademii Nauk SSSR, No 4, 1960, pp 3-10)

Determination of Organic Carbon Content of the Northeast Atlantic

Processing the data obtained during the first cruise of the expeditionary ship "M. Lomonosov" (October-November 1957), the authors obtain an average organic carbon content value of 1.5 mg/l, conclude that there is a dynamic balance of organic carbon in the ocean, and because the annual water humus increment, derived mostly from plankton, is 0.004 mg/l, the annual diminution of water humus in the ocean also is 0.004 mg/l. It is noted that the organic carbon content may aid in determination of the origin of any sample of water. ("Organic Carbon Content of the Northeast Portion of the Atlantic Ocean," B. A. Skopintsev and S. I. Timofeyeva, Doklady Akademii Nauk SSSR, Vol 133, No 3, 1960, pp 677-679)

Biochemical Analysis of Antarctic Deep-Sea Crustacean

Z. A. Vinogradova, of the Odessa Biological Stations, Institute of Hydrobiology, Academy of Sciences USSR, discusses the results of biochemical analysis of the deep-sea crustacean Euphausia superba Dana in the Weddells and Ross Seas. ("Investigation of the Biochemical Composition of the Antarctic Pelagic Crustacean Euphausia superba Dana," by Z. A. Vinogradova, Doklady Akademii Nauk SSSR, Vol 133, No 3, 1960, pp 680-682)

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V. GLACIATION

Continental Emergence Due to Deglaciation

In a two-page article S. A. Ushakov of the Moscow State University imeni M. V. Lomonosov discusses the pliability of the Earth's crust and its reaction to external loads, consisting of glaciated areas. The emergent tendency of North America is cited as due to the last previous ice age. ("Reaction of the Earth's Crust to the Stress of Continental Glaciation," by S. A. Ushakov, Doklady Akademii Nauk SSSR, Vol 133, No 1, 1960, pp 205-207)

VI. ARCTIC AND ANTARCTIC

Effects of Slope Winds in Climate of Pionerskaya Antarctic Station

The author discusses the climate and weather of the region of Pionerskaya meteorological observation station in the antarctic as conditioned mainly by the prevailing down-slope winds characteristic of the Antarctic continent. The article is based mainly on data gathered during the Second Continental Antarctic Expedition. ("Peculiarities of the Nature of the Region of Pionerskaya Station as the Southern Periphery of the Zone of Slope Winds in the Antarctic," by V. M. Kotlyakov, Izvestiya Akademii Nauk SSSR, No 4, 1960, pp 63-72)

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